MUNICIPAL SOLID WASTE LANDFILLS REPORT

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CONTENTS

Section 1.

Introduction

According to the S.C. Department of Health and Environmental Control's 1996 Solid Waste Annual Report, over 1.182 million tons of solid waste was disposed of in landfills in the Berkeley- Charleston-Dorchester Region during FY 96. This volume was disposed in four (4) active municipal landfills; eight (8) industrial landfills; four (4) Construction, Demolition and Land-Clearing Debris Landfills; and, one (1) Ash Monofill Landfill.

Table 1. Landfill Activities by Type & County (Tons/FY96)

Type	Berkeley Co.	Charleston Co.	Dorchester Co.
Municipal	124,355.00	102,224.28	354,694.16*
Industrial	456,304,52	6,000.00	0.0
C & D Deb.	21,203.00	61,331.08	450.00
Ash Mono.	0.0	57,290.82	0.0
Total Tons	601,842.52	226,846.18	355,144.16

* Includes 296,520.68 tons imported from outside Dorchester County.

Source: 1996 Solid Waste Management Annual Report. S.C.DHEC.

Municipal landfills within Berkeley and Charleston Counties are operated by County governments. Dorchester County contracts with Chambers Oakridge Landfill, Inc. for disposal services. Permitted capacities in the Oakridge Landfill are expected to be reached in September, 2010. The capacity of the Berkeley County Landfill may be reached by October 1998. Berkeley County has a permit for another landfill but it has not been constructed as of this date. The capacities of the two Bees Ferry Landfills in Charleston County may be reached by January, 2006. The County is planning to locate a new landfill near the Bees Ferry facility when the existing capacity is reached.

A major environmental concern associated with landfill operations is groundwater pollution. The analysis of leachates from older landfills around the nation have found both biological and chemical contaminants. Chemical contaminants, because they are usually in solution, travel more extensively through subsurface materials than do bacterial contaminants. The movement of bacterial contaminants can be restricted through natural filtering beds. Dissolved chemical constituents will generally contaminate ground (or surface) waters until their concentrations are diluted to the point that their presence cannot be recognized.

It is the intent of this report to relate municipal solid waste landfill management activities to the goals of water quality management

programs within the Charleston Harbor estuary. The following eight Sections of this Report present selected provisions included within state plans or regulations which have an important role in minimizing the negative impacts of municipal landfills on the quality of water resources.

Section 2.
The S.C. Solid Waste Policy and Management Act of 1991

State legislation provides for the regulation of solid waste disposal activities in South Carolina by the Department of Health and Environmental Control. The S.C. Solid Waste Policy and Management Act of 1991 provides the policies and goals for the regulation of municipal solid waste disposal practices. It does not deal with hazardous waste management facilities subject to the S.C. Hazardous Waste Management Act, infectious waste management facilities subject to the S.C. Infectious Waste Management Act, and, radioactive waste facilities subject to the S.C. Atomic Energy and Radiation Control Act, which are all subject to other federal and state laws and regulations.

The policy and goals of the S.C. Solid Waste Policy and Management Act may be summarized as follows:

* to promote the reduction, reuse and recycling of solid waste before landfilling or incineration;

* to encourage research into the reduction of solid waste generated;

* to encourage a regional approach to solid waste management;

* to reduce the amount of solid waste received at municipal solid waste landfills and incinerators by 30 percent, calculated by weight, by May 1997. (The 1996 Solid Waste Management Annual Report notes that the reduction achieved by 1996 was approximately 1 percent);

* to continue to set new and revised reduction goals after the initial six-year period;

* to recycle at least 25 percent, calculated by weight, of the total waste stream generated by this state by May 27, 1997. (The 1996 Solid Waste Annual Report notes that the reduction achieved was at least 25 percent); and,

* that each county or region make every effort to meet the state's solid waste reduction and recycling goals. Those that do will be eligible for specific bonus grants.

The Act provides for the development, and periodic updating, of a State Solid Waste Management Plan, as well as, County or Regional Solid Waste Management Plans which are designed to attain the policy and goals of the Act. It also provides for Annual Reports including changes in the State and Local plans, and progress being made to accomplish the above policies and goals.

Section 3

County or Regional Solid Waste Management Plans.

Since January 1994, each County or Region in the State has been required to have prepared and submitted a Solid Waste Management Plan to the Department of Health and Environmental Control. These Plans must include an analysis of the existing capacities to dispose of Solid Waste and the identification of programs, facilities and finances needed to deal with anticipated waste disposal volumes over a twenty year period.

Required Solid Waste Management Plans also include a description of the resource recovery or recycling programs to be implemented during the twenty year planning horizon. This description includes the designation of a coordinator; the identification of solid waste to be separated, recovered or recycled; methods for collecting and marketing materials; incentives or penalties to ensure program compliance; and, a description of public education programs that will inform the public of the need for and benefits of the program.

Counties are encouraged to take a regional approach to the management of solid waste. Some joint efforts to cooperate on specific projects have stirred local interest among the counties in this three

county region. These discussions have been primarily limited to waste recovery or recycling programs. The need for a regional landfill has not been established and no plans exist to develop such a facility.

Since the adoption of the Solid Waste Policy and Management Act, the Department of Health and Environmental Control has been developing regulations implementing various sections of the Act and the State Plan for Solid Waste Management. In 1995, specific regulations establishing minimum criteria for regulating all municipal solid waste landfills was approved by the legislature and implemented by the Department of Health and Environmental Control.

Section 4.
Location Restrictions for New and Existing Landfill Units, or, Lateral Extensions to Existing Landfills.

A municipal solid waste landfill (MSWLF) unit is defined as "a discrete area of land or an excavation that receives household waste, and that is not a land application unit, surface impoundment, injection well, or waste pile as those terms are defined in the Act. A MSWLF unit may also receive other types of RCRA subtitle D wastes, such as commercial solid waste, nonhazardous sludge, conditionally exempt small quantity generator waste and industrial solid waste.

Subpart B of the Regulations include Location Restrictions for new and existing Municipal Solid Waste Landfills. These restrictions deal with, 1. Airport Safety; 2. Floodplains; 3. Wetlands; 4. Fault Areas; 5. Seismic Impact Zones; 6. Unstable Areas; 7. Hydrogeologic Considerations; and, 8. Buffer Zones. A summary of the location restrictions dealing with each of these topical areas follows:

1. Airport Safety.

Owners or operators of facilities located within 10,000 ft. of any airport runway end used by turbojet aircraft or within 5,000 ft. of any airport runway end used by only piston-type aircraft must demonstrate that the units are designed and operated so that the Landfill unit does not pose a bird hazard to aircraft.

An "Airport" means a public-use airport open to the public. A "Bird hazard" means an increase in the likelihood of bird/aircraft collisions that may cause damage to the aircraft or injury to its occupants.

2. Floodplains.

Owners or operators of facilities located in 100-year floodplains must demonstrate that the unit will not restrict the flow of the 100-year flood, reduce the temporary water storage capacity of the floodplain, or result in wash out of solid waste so as to pose a hazard to human health and the environment.

3. Wetlands.

Landfill units shall not be located on wetlands unless it can be demonstrated that:

a. alternative sites which do not involve wetlands are not available;

b. The construction and operation of the landfill unit will not;

1. Cause or contribute to violations of any applicable State water quality standard;

2. Violate any applicable toxic effluent standard or prohibition established by the Clean Water Act;

3. Jeopardize the continued existence of endangered or threatened species or result in the destruction of critical habitat, protected under the Endangered Species Act of 1973; and,

4. Violate any requirement under the Marine Protection, Research, and Sanctuaries Act of 1972 for the protection of a marine sanctuary.

c. The landfill will not cause or contribute to the significant degradation of wetlands. The owner/operator must demonstrate the ability of the unit to protect ecological resources by addressing the following factors:

1. Erosion, stability, and migration potential of native wetland soils, muds and deposits used to support the landfill unit;

2. Erosion, stability, and migration potential of dredged and fill materials used to support the landfill unit;

3. The volume and chemical nature of the waste managed

in the landfill;

4. Impacts on fish, wildlife, and other aquatic resources and their habitat from the release of solid waste;

5. The potential effects of catastrophic release of waste to the wetland and the resulting impacts on the environment; and,

6. Any other factors necessary to demonstrate that ecological resources in the wetland are sufficiently protected.

d. Show that steps have been taken to attempt to achieve no net loss of wetlands by first avoiding impacts to the maximum extent possible, then minimizing unavoidable impacts to the maximum extent possible, and finally by offsetting remaining unavoidable wetland impacts through all appropriate and practicable compensatory actions; and,

e. Sufficient information must be available to make a reasonable determination with respect to these determinations. In lieu of these demonstrations the applicant may submit proof that it has obtained the permits and/or authorizations required by all other state and federal laws and regulations.

4. Fault Areas.

Landfill units shall not be located within 200 feet of a fault that has had displacement in Holocene time unless the owner or operator can

demonstrate that an alternative setback distance of less than 200 ft. will prevent damage to the structural integrity of the unit and will be protective of human health and the environment.

5. Seismic Impact Zones.

Landfills shall not be located in seismic impact zones unless the owner/operator demonstrates that all containment structures, including liners, leachate collection systems, and surface water control systems, are designed to resist the maximum horizontal acceleration in lithified earth material for the site.

6. Unstable Areas.

Owners or operators of proposed landfills or extensions of existing landfills, in unstable areas must demonstrate that engineering measures have been incorporated into the units design to ensure that the integrity of the structural components of the unit will not be disrupted.

7. Hydrogeologic Considerations.

a. New landfill units, and expansions of existing units, should be located in areas where:

1. the migration of groundwater in the uppermost aquifer should remain in the uppermost aquifer until it discharges into the perennial stream nearest to the disposal area. (i.e., a lateral or an upward hydraulic gradient should exist);

2. a minimum three (3) foot separation of naturally occurring material or an appropriate amount of equivalent engineered material can be maintained between the base of the constructed liner system and the high water table as it exists naturally;

3. a minimum ten (10) foot vertical separation of naturally occurring or engineered material can be maintained between the base of the construction liner and bedrock; and,

4. the unit is not located over an area where a stratum of limestone exhibiting secondary permeability with an average thickness of greater than five feet, lies within fifty feet of the base of the unit.

b. New units and expansions to existing units are prohibited in areas where a owner or operator cannot demonstrate;

1. that the location would not result in the destruction of a perennial stream; be within two hundred (200) feet of a perennial stream; be within that portion of a drainage basin included within a 2,500 foot radius on the upstream side of a public drinking water supply intake, and is within 1,000 feet of a lake, pond, or reservoir used as a source of public drinking water; and,

2. that the hydrogeologic properties of the site can be adequately characterized.

c. New units and expansions of existing units will not be located over class GA groundwater or over the recharge area for Class GA groundwater as designated by the Department,

over a sole source aquifer, or over the recharge area for a sole source aquifer as designated by the Department.

8. Buffer Zones.

New units and expansions to existing units shall not be located:

a. within 100 feet of any property line not under control; of the owner or operator;

b within 200 feet of any surface water body which holds visible water for greater than six consecutive months, excluding ditches, sediment ponds, and other operational features on the site;

c. within 200 feet of any residences, schools, hospitals and recreational park areas, existing at the time of the permit application, or unless such features are included in the site design for a planned end-use; and,

c. within the following distances from groundwater uses for human consumption that exist at the time of permit application.

1. 500 feet hydraulically upgradient of the waste disposal unit;

2. 750 feet hydraulically side gradient of the waste disposal unit; or,

3. any distance directly hydraulically downgradient from the waste disposal unit to the point of discharge for the uppermost aquifer flowing beneath the disposal unit.

Section 5.
Operating Criteria for Landfills

Subpart C of the regulations deal with the operational requirements associated with municipal landfills. They include provisions for excluding the receipt of hazardous waste as defined by the state and the federal government via the federal Resource Conservation and Recovery Act; disease vector control; explosive gases control; air quality (must not violate the provisions of the Clean Air Act which severely limits open burning as a waste management technique, and blowing litter control); access requirements (which control access and prohibit salvaging and scavenging); and, equipment. Other operating requirements which have a more direct effect upon water quality impacts of impacts include:

1. Cover Material Requirements which provide that owners or operators must cover disposed solid waste with six (6) inches of earthen material at the end of each operating day, or at more frequent intervals if necessary, (fires, vector control, odors, litter, etc.). If the owner/operator can demonstrate that a material provides equal protection to six inches of earthen material it may be approved by the Department.

2. Run-on/Run-off Control Provisions which require the owner or operator to design, construct and maintain a run-on control system to prevent flow onto the active portion of a landfill during the peak discharge

from a 25-year storm, and, a run-off control system from the active portion of the landfill to collect and control at least the water volume resulting from a 24-hour, 25-year storm.

3. Surface Water Requirements which provide that landfills shall not cause a point or nonpoint source discharge that violates any requirements of the Clean Water Act.

4. Liquids restrictions limiting the volumes and types of liquids that may be placed in landfills, and, the type and size of containers holding liquids. Only liquid household waste other than septic waste, leachate or gas condensate derived from the landfill unit, may be within the landfill.

5. A Leachate Handling Agreement certifying the acceptance of leachate by the operator of a wastewater treatment facility, or a state pollution discharge elimination permit shall be obtained prior to the initial receipt of waste at the facility.

6. Leachate Control shall include best efforts to ensure that the leachate head above the liner system does not exceed one (1) foot, except for brief periods not to exceed one (1) week, due to circumstances beyond the immediate control of the owner or operator.

Section 6.

Design Criteria for New Landfills and Lateral Extensions to Existing Landfills.

Subpart D. of the Regulations include design criteria for landfills which require techniques which were new and revolutionary to local municipal landfill operations. Intended to keep polluted materials within the landfill and to collect and remove leachate, these requirements made landfill construction and operations a significant item in every county budget in the state. The balance of this Section provides a summary of the major requirements to be included in the design process.

1. New landfill units and lateral expansions shall be constructed:

   a. in accordance with a design approved by the Department. The design must ensure that the concentrations of various pollutants listed in the regulations do not exceed specified levels in the uppermost aquifer at the relevant point of compliance. The relevant point of compliance shall be specified by the Department and be no more than one hundred fifty (150) feet from the waste management unit boundary; or,

   b. with a composite liner and a leachate collection system that is designed and constructed to maintain less than one (1) foot depth of leachate over the liner, except in sumps. A "composite liner" means a system consisting of two (2) components; the upper

component must consist of a minimum 30-mil flexible membrane liner (FML), and the lower component must consist of at least a two (2) foot layer of compacted soil. FML components consisting of High Density Polyethylene shall be at least 60-mil thick. The FML component must be installed in direct and uniform contact with the compacted soil component.

2. The leachate collection and removal system shall be designed and built to operate without clogging during the operational life of the site and post-closure maintenance period. This system shall also be designed to ensure that the hydraulic leachate head on the liner system does not exceed one (1) foot as a result of a 24-hour, 25-year storm event during the active life and post-closure period of the landfill facility.

3. Filter layers shall be designed to prevent the migration of fine soil particles into a coarser grained material, and allow water or gases to freely enter a drainage medium without clogging.

4. The total thickness of the drainage and protective layers above the liner material shall be a minimum of two (2) feet thick.

5. A foundation analysis shall be performed to determine the structural integrity of the subgrade to support the horizontal and vertical stresses and overlying facility components.

6. A separation of three (3) feet shall be maintained between the base of the constructed liner system and the high water table.

7. The soil component of the liner system shall be placed on a slope of no less than two percent to promote positive drainage across the liner surface and at a maximum slope not greater than thirty-three percent to facilitate construction.

8. All storm water ditches should have a minimum slope of 0.5 percent or a minimum permissible non-silting velocity of two feet per second.

9. For landfill expansions the Department may approve encroachment upon the existing landfills side slopes only if a leachate barrier system is designed and constructed to eliminate leachate migration into the existing landfill.

Section 7.
Groundwater Monitoring

Subpart E. of the Regulations provides groundwater monitoring and corrective action requirements which call for a self monitoring system to ensure that hazardous materials do not escape from the landfill. If they do the owner or operator is required undertake corrective action.

1. Once established at a landfill unit, groundwater monitoring shall be conducted to yield representative groundwater samples from the uppermost aquifer throughout the active life and post-closure care period of that landfill unit. Monitoring systems must monitor for all constituents identified within the Departments Regulations, and occur on at least a semiannual time table.

2. The groundwater monitoring program must include consistent sampling and analysis procedures to ensure monitoring results that provide an accurate representation of groundwater quality at background and downgradient wells.

3. The owner/operator shall submit to the Department on or before the anniversary date of issuance of the permit, an annual report containing all of the analytical and statistical analysis performed at the site for the previous year.

4. After completing sampling and analysis, the owner or operator must determine whether there has been a statistically significant increase over background for each metal or other hazardous constituents requiring statistical analysis at each monitoring well. If a statistically significant increase has been detected and validated, an Assessment Monitoring Program must be initiated within a ninety day time limit. (See section 258.53.h of the Municipal Solid Waste Landfills Regulations for specific Sampling and Analysis Requirements).

5. Upon a finding that a hazardous constituent has been detected at a level exceeding groundwater protection standards, the owner or operator must initiate an assessment of corrective measures.

6. Based on the results of the corrective measures assessment, the owner or operator must select a remedy that, at a minimum, attains the groundwater protection standard.

Section 8.
Closure and Post-Closure Care

1. Owners or operators must install a final cover system that is designed to minimize infiltration and erosion. This cover system shall include an infiltration layer that achieves an equivalent reduction in infiltration as would 18 inches of earthen material, and, an erosion layer that provides equivalent protection from wind and water erosion as 12 inches of earthen material capable of sustaining native plant growth.

2. The owner or operator must prepare a written closure plan that describes the steps necessary to close all landfill units at any point during their active life. The closure plan must include a description of the final cover and the methods and procedures to be used to install the cover.

3. Following closure of each landfill unit, the owner or operator must provide the Department with a certification, signed be a SC registered professional engineer other than the design engineer, verifying that closure has been completed in accordance with the closure plan. A notation on the deed for the property must then in perpetuity notify any potential purchaser that the land has been used as a landfill and that its use is restricted.

4. All facilities constructed with liner systems in accordance with this regulation shall install a final cover system which consists of:

a. a gas management layer or layers, or other gas management design, as necessary;

b. 18 inches of compacted soil capable of providing a suitable foundation for a flexible membrane liner;

c. a 20-mil flexible membrane liner with a maximum permeability equal to or less than the bottom layer system.

d. drainage layer; and,

e. a minimum two feet of soil capable of supporting native vegetation.

5. The final cover system shall be constructed to preclude precipitation migration into the landfill. It shall also be placed on a slope of no less that two percent to promote positive drainage and a maximum slope no greater than thirty-three percent to facilitate construction and prevent erosion.

6. Following the closure of each landfill unit, the owner or operator must conduct post-closure care for at least thirty years. Such care shall at least include:

a. Maintaining the final cover, including making repairs as necessary to correct the effects of settlement, subsidence, erosion or other events, and preventing run-on and run-off from eroding or otherwise damaging the final cover;

b. Maintaining and operating the leachate collection and disposal system;

c. Monitoring groundwater and maintaining the groundwater monitoring system; and,

d. Maintaining and operating the gas monitoring system.

7. The length of the post-closure care period may by increased or decreased by the Department if the Department determines that such change sufficiently provides adequate protection to human health and the environment.

8. The owner or operator of all landfill units must prepare a written post-closure plan that includes, at a minimum:

a. a description of the required monitoring and maintenance actives;

b. a name/office to contact about the facility during the post-closure period; and,

c. a description of the planned uses of the property during the post-closure period.

9. Following the completion of the post-closure care period for each landfill unit, the owner or operator must notify the Department that a certification, signed by a SC registered engineer other than the design engineer, verifying that post-closure care has been completed in accordance with the post-closure plan, has been placed in the operating record.

Section 9.
Watershed Management Considerations

The S.C. Department of Health and Environmental Control (DHEC) has developed and implemented a very comprehensive planning program designed to reduce volumes of solid waste, keep inappropriate materials out of municipal landfills, and, protect water quality. DHEC policies and requirements included in the previous sections of this report should be incorporated into Watershed Management Planning programs as that planning element dealing with municipal landfills.

The S.C. Department of Natural Resources (DNR) does recommend that landfill location criteria include the guideline that landfills should be located at least three (3) kilometers from waterbird nesting sites to

reduce the possibility of concentrating predators near waterbird colony sites. Waterbirds include: the Cattle, Snowy and Great Egrets; Great Blue, Little Blue, Tri-color, Yellow-crowned Night and Black-crowned Night Herons; White and Glassy Ibus; Wood Storks; Double Crested Cormorants; and, Anhingas.

Presently, the lack of suitable nesting sites within the Charleston Harbor estuary appears to be the major factor limiting waterbird populations. Data collected by the Department of Natural Resources indicates that roost sites for wading birds may be used consistently for 15 or more years. The Department maintains an inventory of existing sites which should be avoided whenever possible.

Concerns associated with all planning and management programs usually center upon the implementation phases of the management program. The regulations originating from the policies and goals of the S.C. Solid Waste Policy and Management Act of 1991, placed both financial and operating burdens upon local governments, private operators and those enforcement agencies involved in solid waste disposal activities. Counties were especially impacted because they were essentially mandated the responsibility to finance and implement most of the municipal solid waste provisions of this Act.

As of this date, the only municipal landfill in this Region which has been permitted or modified to meet RCRA Subtitle D standards is the

Chambers Oakridge Landfill in Dorchester County. Berkeley and Charleston Counties will be expending significant financial resources to dispose of waste in the relatively near future. The major expense of constructing and operating a landfill which meets DHEC's standards may encourage that more consideration be given to the concept of a regional landfill. The cost of an adequate site in a central location, and the associated costs of transferring waste from their place of origin to a regional landfill, may exceed the benefits that may be derived from the construction and operational savings a regional landfill may offer.

Compliance is another concern in the implementation of the State Solid Waste Management Program. Ignorance, poverty, apathy and greed will all drive human actions which cause compliance problems. Education, resources and enforcement activities are all needs to make the system work. Education programs are being directed to overcome ignorance and apathy. These programs need to be continued. Poverty means a lack of resources among those responsible for implementing the provisions of this Act. Those responsible include implementing organizations, as well as, those organizations responsible to the people of this State to ensure that implementing activities are completed in a responsible manner. Poverty and greed can both be dealt with if resources are adequate to enable planning, implementing, and monitoring organizations to operate in a responsible manner.